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September 5, 2:15 P. M.—Merced.

September 19, 12:15 A. M.—Calico, Barstow, Daggett, San Bernardino.

October 3, 1:05 P. M.(?)—Healdsburg.

October 29, 8:36:29 (IV), and 8:39:29 (III) Mt. Hamilton.

December 4, 9 P. M.—Lone Pine. A series of shocks, lasting until 11 P. M. J. E. K.

EXAMINATION OF THE LICK OBSERVATORY NEGATIVES OF THE MOON.

In order to obtain all the information which is contained in a negative of the Moon, it is necessary to make a positive copy of it on glass, which shows the lights and shadows as they really are, *i. e.*, white as white and dark as dark. On the positive the eye can at once pick out familiar features or detect new ones, which are not readily apparent on the negative, until they have first been found in their natural colors. In making these positive copies it is usually sought to give such an exposure as will produce the best general plastic effect in the resulting plate—such as will make the best “picture,” as is said. But every single feature on the Moon, and thus on the negative, has an illumination and a distinctness of its own. If we vary the exposure-times in making the copies we shall thus be able to exhibit certain special regions in a new light, which is also a true one as to form, though the photometric contrast with neighboring regions may be exaggerated. Suppose, for example, that in copying a certain negative the best general pictorial effect is obtained by exposing it for 30 seconds to the light of a lamp 18 inches distant. This makes the picture which is wanted by artists, etc., and gives the truest general effect. Some parts of this copy are necessarily much over-exposed, and some parts of it are much under-exposed, but the result is the best general average.

Now suppose that instead of confining ourselves to making this one copy of 30 seconds exposure, we make a series of copies (all at the same distance from the lamp), with exposures of 10, 20, 40, 50, 60, 70 and 80 seconds. What will be the result? We shall have a series of copies in which the photometric contrasts are all exaggerated, but in which the topographic forms are all truly kept. Nothing is shown (if proper precautions are taken) which is not in the original negative, but what *is* there is shown in new lights. All this is very familiar to photographers, no

doubt, but some experiments in this direction which Mr. BARNARD has been kind enough to make for me have shown that this method is worthy of special attention, and that it is capable of producing new and important results, and of leading to veritable discoveries which can, I think, be made in no other way.

An examination of such a series of positive copies has shown me that the systems of bright, radiating streaks on the Moon can be exhibited in quite new relations. For example, it is positively stated by SCHMIDT that no one of the bright streaks about *Tycho* can be traced nearer to the crater wall than the *exterior* boundary of the gray *nimbus* surrounding the crater. The positives show more than one streak extending quite through the whole width of the *nimbus* and up to the wall. Again, certain plates of the series show quite new craters, never seen before. For example, a ruined crater ring is shown near *Copernicus*,* of which no trace can be seen in the map of SCHMIDT, etc. These features certainly exist, for, after they have been detected in the positives, they can be seen in a whole series of negatives. Many of them can never be seen with the naked eye, because the light of the Moon is too dazzling to allow faint contrasts to be seen. But they certainly exist, because they are readily visible in many negatives, taken on different nights, as soon as the positives have shown us exactly where to look for them.

I consider it a matter of some importance to have found new features of this class—as, for instance, to have discovered a previously unknown crater, which forms a part of the region round *Copernicus*, and whose history is intimately connected with the ancient history of the latter formation; but the most important matter is to have become possessed, through photographic processes, of an entirely new engine of research.

From what I have already seen, I am sure that hundreds of significant additions can be made to existing lunar maps by treating the Moon-negatives of the Lick Observatory in this way.

E. S. H.

MOUNT HAMILTON, February 4, 1891.

* It is nearly of the same diameter as *Copernicus*, its shape is more elliptic, its center is nearly in the line joining the centers of *Autolycus* and *Copernicus*, and its west wall almost touches the southeast wall of the latter crater.

PERMANENT IMPROVEMENTS AT MOUNT HAMILTON.

The Regents of the University have set apart the sum of \$1000 from the capital of the Lick Fund, to be expended in providing new reservoirs, etc., and in general improvements to the water supply. This sum is sufficient to secure an adequate provision of water for all domestic uses.

The sum of \$700 has been expended during the winter on repairs to our telegraph and telephone line. The line is now in first-class condition for some seven miles from San Jose, and in good condition the rest of the way.

E. S. H.

APPOINTMENT OF MR. KEELER TO THE ALLEGHENY OBSERVATORY, AND OF MR. W. W. CAMPBELL
TO THE LICK OBSERVATORY.

Mr. KEELER has accepted the position of Professor of Astronomy in the Northwestern University of Pennsylvania and Director of the Allegheny Observatory, and has tendered his resignation as Astronomer in the Lick Observatory, to take effect June 1, 1891. He leaves behind him at the Lick Observatory a record of admirable work admirably done, and he takes with him our best wishes for his future success in his new field.

Mr. KEELER's resignation was presented to the Regents of the University at their May meeting and the following resolution was adopted by them:

Resolved, that in accepting the resignation of Mr. KEELER, the Regents desire to express their high appreciation of his astronomical work at the Lick Observatory and that they wish him every success in his new position.

Mr. W. W. CAMPBELL, lately Instructor of Astronomy at the University of Michigan, was appointed Astronomer in the Lick Observatory, to date from June 1, 1891.

At the June meeting of the Regents an additional Astronomer was authorized, whose chief work is to be in Spectroscopy. No appointment has yet been made.

E. S. H.